

POWER UNDER PRESSURE

Oil Pumps For Optimum Performance

Oil pumps, especially in racing applications, are typically regarded as part of a complete oiling system. Whether wet sump or dry sump, high-volume or otherwise, these components are often described as the heart of an engine, with oil, naturally, as the lifeblood.

Indeed, the importance of a quality oil pump cannot be overstated, particularly when investing heavily in parts and machining of a race engine. And selecting the proper parts for a race car's oiling unit is paramount.

"Using the very best parts in your oiling system is what fits the rest of the project, even if you are using stock parts," said Bob Sanders of Titan Speed Engineering, Ojai, California, who cited cavitation as just one potential byproduct of improper

pump selection.

"Staying away from the dreadful cavitation caused by some pumping systems is what makes the difference in getting that extra 50 horsepower while having your bearings stay perfect, and that leads directly to the winner's circle.

"The wrong oil pumps do cavitate, and that causes drive failures on both the driveshaft and the drive gear, bad spark scatter—if your distributor is above the oil pump," Sanders continued. "The bearings suffer during the time the cavitation occurs, and you lose horsepower while the bearings are burning. A lot of times the poor performing pumps will just fall off from cracks caused by cavitation."

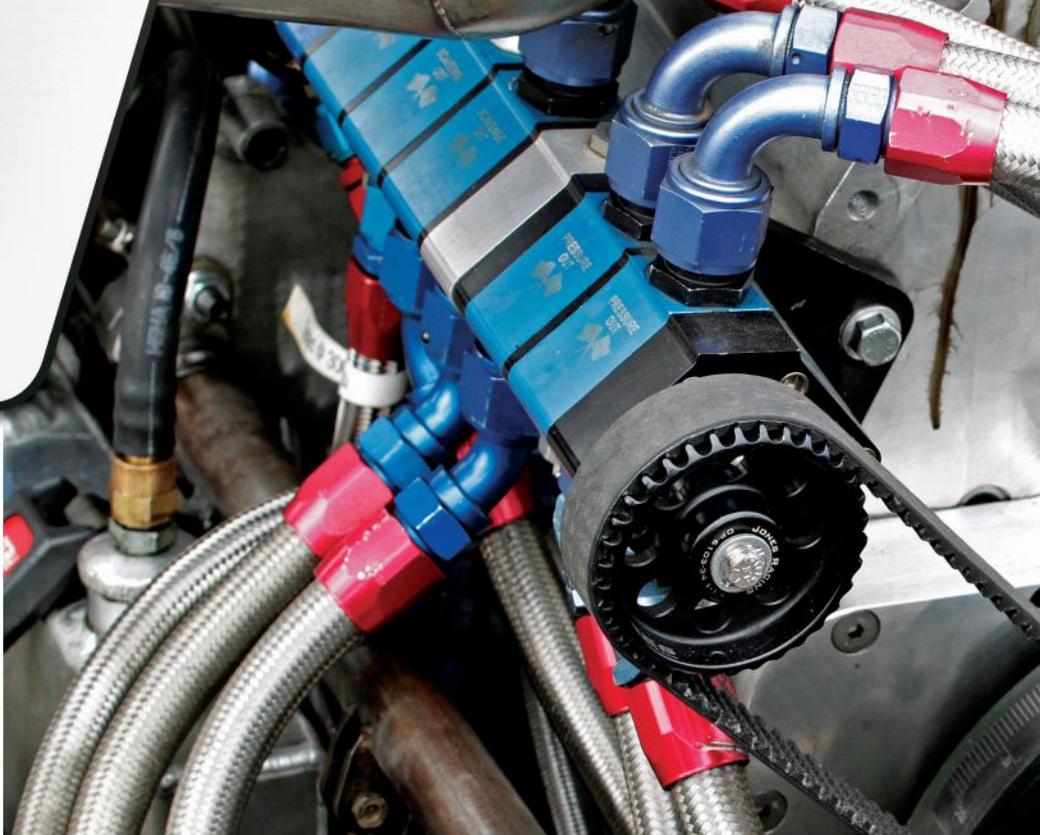
According to our sources, only a high-quality oil pump that is applied properly will deliver the desired reliability and performance that racers and engine builders expect.

"The wrong pump selection can result in an engine's poor performance or diminished life expectancy," confirmed Thor Schroeder of Moroso, Guilford, Connecticut.

Proper part selection is critical to ensuring race engines operate with maximum efficiency, and our sources offer valuable insight on products and solutions for this key category.

By Nick Gagala





The importance of using a quality oil pump cannot be overstated, particularly when investing heavily in parts and machining of a race engine. And selecting the proper parts for a race car's oiling unit is paramount. So, according to our sources, only a high-quality oil pump that is applied properly will deliver the desired reliability and performance.

In fact, Gary Armstrong of ARE Dry Sump Systems in Loomis, California, told us there is a science to selecting the proper racing oil pump. "And the type used is critical to optimum performance," he added. "Higher pressure or volume is, in itself, not the whole picture."

Let's further examine factors that should be considered for proper oil pump selection, as well as some of the top markets and latest products in the category today. We'll also touch on a few current and future developments in oil pumps.

Proper Pump Selection

When should racers run high-volume oil pumps or high-pressure oil pumps? And when should they run standard-volume ones? Simply put, it depends on the race application.

As a guidepost, Moroso's Schroeder said if a customer has a rear sump, where the deepest part of the oil pan is situated toward the back of the vehicle, and the oil pump is at the front of the engine with a big, long oil pump pick-up tube, he recommends a high-volume oil pump.

"If the vehicle has an oil cooler, remote filter and an extra-capacity oil pan, [and it's] a street/strip car that also might see an autocross or go on a road course, I would

recommend a high-volume oil pump," he said. "If the vehicle is being used for drag racing, or it's a street/strip car that will only be raced in a straight line and has to run a stock-capacity oil pan, then I would recommend a standard-volume oil pump."

For vehicles that run an extra-capacity oil pan, and are used in drag race applications where the driver is less inclined to watch the gauges, Schroeder suggests a high-volume oil pump. "If the last horsepower is trying to be freed up in a drag race car—even those with extra capacity oil pans—then I would recommend a standard-volume oil pump, but stress that the operator has to be aware of what the gauges are telling them, and to act if there is a severe pressure drop," he explained.

The choice between dry sump and wet sump setups hinges on several factors, including price, weight, power needs and sanctioning body rules, to name a few.

"Packaging ranks right up there also, as a wet sump pump can be contained right inside the oil pan," Schroeder said. Whereas, in a dry sump pump setup, the pump itself is mounted outside of the oil pan, he added.

"Weight is another big advantage of a wet sump pump—you don't have the



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OIL PUMPS

extra weight of the tank and lines, and the pump itself can weigh less than half of a dry sump pump," he added.

Roy Johnson of Johnson's High Tech Performance in Valencia, California, said customers must know their engine's system requirements before buying an oil pump. "Most people don't understand that engines don't require pressure; they require volumetric efficiency. To get that, you need to determine what the efficiency or inefficiency of the pump you are going to buy is," he said.

"Most consumers just think that you need an oil pump that makes pressure, and, unfortunately, they lose a lot of horsepower and overheat the oil by adding pressure to it. And that all has to do with the volumetric percentages of the pump itself," he added.

Clearances represent another concern for pumps, Johnson told us. "The more clearance you have, the less efficient the

pump is," he said. "The volumetric efficiency is measured in percentages. For instance, our pumps at startup are 95–98 percent in volumetric efficiency. In other words, the pump is delivering 95–98 percent of oil and less than five percent of vapor to the engine.

"In a pump, the more clearance you have the more slip you have. Then that creates cavitation. And cavitation is generally why most race engines have a very short-term life," he added.

Oil pumps at Henderson, Colorado-based Peterson Fluid Systems are sized by rotor length, according to Rod Thomson, who noted the company's model R4 pumps are among its most popular. "The longer the rotor, the more volume the pump is capable of," he explained. "The best number to have is what the engine's maximum gpm usage is. However, a lot of engine dynos are not equipped with a flow meter. Hose AN size from the oil tank,

as well as the length of hose, needs to be known, too.

"Incorrect sizing of the pressure section of the pump can cause two main problems: An undersized section not large enough to meet the engine's oil requirements will cause cavitation in the oil pump," Thomson cautioned. "The oil pump will generally be very noisy, and you will notice your oil pressure falling off as engine rpm's increase, and rising again when the rpm's decrease. This condition can also be caused by too small of an inlet-line hose. A section too large typically has either good idle pressure and exceedingly high top-end pressure, or low idle pressure with normal to high top-end pressures."

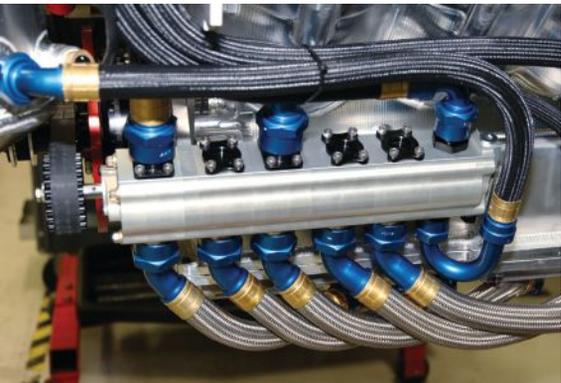
According to Armstrong, ARE Dry Sump Systems determines the flow requirements of individual engines based on multiple factors, including displacement size, number of cylinders, whether it's tur-



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Racers must be reminded that higher pressure or volume should not be sole factors when determining a pump. As one supplier explained, the wrong pump selection can result in an engine's poor performance or diminished life expectancy.

bocharged or supercharged, or if it's an alloy block. "If it is an uncommon engine being built for racing, we also calculate the flow rate of the stock pump to get an idea," he said.

System 1 Filtration in Tulare, California,

specializes in oil pumps for most pro categories of drag racing, and Mark Mittel said the company determines the correct oil pump for its customers by gear length. "If you get too big of a pump on the car—and I don't care what motor it is, they all hide oil upstairs—it pumps all of the oil upstairs and it can't get back quick enough, until they step off of the throttle and here comes all this oil," Mittel said. "It's like a high-pressure system up on the top side of the motors. With too big of a gear section, it will pump the majority of the oil upstairs and it never comes back during the run."

At Jackson, Michigan-based Melling Performance, Mike Osterhaus revealed one question that's frequently asked of his tech department: "How tight are the bearing clearances in the engine?"

Osterhaus explained, "If the engine is built with factory or tighter than factory bearing clearances, then a stock-volume

oil pump is typically the best choice. If the engine is built with larger clearances, then a high-volume oil pump is recommended. The increase in oil flow or volume from the oil pump will be required to fill the additional bearing clearances. If a stock-volume pump is used on an engine with larger clearances, then the oil flow produced by the oil pump may not be sufficient to build good oil pressure in the engine. Engine damage may then occur."

On the other hand, he said, if a high-volume pump was used on an engine with factory clearances, then greater oil flow will be supplied to the bearings and the oil pressure will increase. "The increase is usually not high enough to do any damage to the oil filter or gaskets," he continued. "But a high-volume oil pump will consume more power during operation. That power could be saved by using a stock-volume oil pump."

One of the biggest misconceptions in



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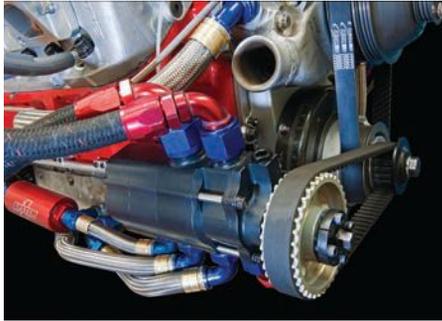
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OIL PUMPS

today's market is that oil pumps "make pressure," according to Osterhaus. "In reality, the oil pump creates a flow of oil which, when supplied to the bearings, produces the oil pressure found on the gauge," he explained. "Given the same bearing clearances, if you install a high-volume pump, the increase in oil flow will produce an increase in oil pressure across the engine's operating range."

Indeed, Verne Schumann of Schumann's Sales & Service in Blue Grass, Iowa, believes oil-pressure gauges too often give racers a false impression. "For example, most of our oil pumps in the professional line are designed to get rid of aeration and cavitation, and if you've got oil that is 30-40 percent aerated, the oil pressure gauge does not give you an indication of the percentage of aeration," he said. "The same gauge will measure air pressure, water pressure, gas pressure, oil pressure, and anything you put in against



The choice between dry sump and wet sump setups hinges on several factors, including price, weight, power needs and sanctioning body rules, to name a few. Photo courtesy of Auto Verdi.

the diaphragm of the gauge. So you can have a nice oil-pressure reading on the gauge and have 30-40 percent aeration in the oil. You are about to lose the bearings in the engine. It's just false security."

Leo Rayas of Barnes Systems in Torrance, California, also cautioned that racers sometimes assume that all dry sump pumps are the same. "Having the

largest pump with the most stages may not be the best configuration for that particular application," he said. "It is always best to get some recommendations from engine builders or pump manufacturers so that the racer is not driving something that can potentially be robbing power from their engine."

Hot Markets, Products

The markets into which Aviaid Oil Systems of Chatsworth, California, sells its oil pumps have evolved over time, according to John Schwarz, who cited street, track day cars and restomods as especially hot segments.

"We've always built the parts that we know we need," Schwarz said, "but it's all done in such a way that we don't really have standard pumps, because every pump is built from scratch, starting from a configuration sheet. With the variety of different components that we have, we can pretty much work with any engine builder

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or customer to eventually build what he needs to fit into his application.”

Simi Valley, California-based Milodon has been expanding its oil pump line to include its own small block and big block Chevrolet cast-iron oil pumps. The company offers five different oil pumps in several configurations for the small block Chevy: standard volume, standard volume/high pressure, high volume/high pressure, high volume/high pressure with a three-quarter inlet and a big block style high volume/high pressure. For big block Chevy, Milodon offers a high volume/high pressure oil pump.

Milodon’s cast-iron pump bodies are made of a 40,000 psi “G-10” material, a strong material that is normally used for brake rotors. They are CNC machined to precision tolerances, and every pump is 100 percent flow tested. “One of the misconceptions out there is you have to go with a billet pump for drag racing,” Ken

Sink said. “I have more sportsman class racers running our big block and small block Chevrolet cast-iron pump than you can imagine. When we designed our pump, we made the necks thicker in key areas, with improved machined radius to avoid cracks around the bolt flange pad area.” Sink said that this design helps eliminate oil pump failure due to the pump head breaking off.

“Circle track, the modified claimeer, hobby and street stock classes are price conscious and need a quality pump at a reasonable price,” Sink said. “When these cars are running on a rough track with the severe rpm changes, the oil pump and pick-ups are subjected to a tremendous amount of abuse and need the stronger housing material and thicker neck to ensure they do not fail.”

Specializing in dry sump oil pumps, Sweden-based Auto Verdi AB’s largest market for these products is unquestion-

ably NASCAR, according to Stefan Verdi. “After that it’s drag racing, and then all kinds of circle track, and even some ultra-boat applications,” he said.

Auto Verdi’s NASCAR-approved oil pumps come in five or six stages, with open or restrictor engine designs available upon customer request. Standard or high-volume pressure gears are offered in a range from 28–35 mm/1.102–1.377 inches.

Oil pump drive systems from Ottsville, Pennsylvania-based Jones Racing Products are tailored to specific applications, according to CJ Jones. “Focus on belt and pulley style, the correct belt length for any center line measurement, whether it is for a fixed pump location or adjustable—all while keeping the pump ratio correct to the engine rpm,” he advised.

Jones added, “With today’s race engines reaching higher rpm’s, the use of Jones Racing Products’ radius tooth pulleys is a benefit the racer needs to

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ensure a smooth operating system with lower drag placed on the pump's shaft and bearings, plus the added benefit of a wide selection of belt lengths and pulley ratios readily available for any application."

Titan Speed Engineering's newest 1300 Nitro Pumps, "are slightly larger volume in order to keep idle pressure up with the newer, much thinner oils being used in some Nitro motors," Sanders told us.

At December's PRI Trade Show, Moroso introduced new part numbers for its Tri-Lobe line of dry sump pumps with brackets to mount the pumps in different orientations than previously offered. "This spring, Moroso is [releasing] a line of our Tri-Lobe dry sump pumps with a fuel pump drive off the back," Schroeder said. "The last couple of years, prototypes have been out in the field on actual race cars, but we decided it is time to offer them as an on-the-shelf part number."

ARE, meantime, has been contracted

to design new systems for turbo diesel racing engines, which resulted in slightly new design configurations, as well as additional pump mount and drive options, Armstrong noted.

Melling's Shark Tooth performance oil pumps, released last year for GM Gen 1 small block V8 applications, have developed a following among performance engine builders, Osterhaus said. The traditional spur gears have been replaced by helical asymmetrical gears designed specifically to improve oil pump performance, he said. "Typically that would mean more flow, but our goal was to improve the quality of the oil flowing to the engine."

That improved oil flow removes some 70 percent of the pressure ripple found in traditional spur gear oil pumps, Osterhaus told us, adding, "Reduction of the hydraulic pulsing in the engine's lube system allows for improved operation of the distributor and reduced wear on the cam-

shaft and distributor drive gear."

Buoyed by its Stealth line, Johnson's High Tech Performance counts circle track as its top oil pump market, Johnson said. That Stealth line features one- through six-stage oil pumps for the small block Chevy mount, as well as a four-stage dry sump pump for the Ernie Elliott Ford mount.

Schumann's Sales & Service's dual feed small block Chevy oil pumps supply equal amounts of oil to the bottom of the gears and the top third of the gears during engine operation, Schumann said.

"When [GM] designed the pump for a small block 265 Chevy, nobody dreamed about 440-inch small blocks or 9000 rpm. So with the factory-designed pumps, the oil comes in through a 5/8 or a 3/4 hole, goes underneath the gear set, and then it has to go vertically up the gear set, which oil doesn't want to do," Schumann said. "And with our dual feed pump, inside the casting internally is a second passage-

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Racers oftentimes fail to realize that engines don't require pressure, according to one manufacturer. Instead, they require volumetric efficiency. So, it's up to the racing retailer or engine builder to determine the efficiency or inefficiency of the oil pump being considered. Photo courtesy of Johnson's High Tech Performance.

way, so half the oil goes to the top of the gears. When you've got oil available at the top of the gears, the air is displaced and a higher percentage of good lubrication is available."

Current&FutureDevelopments

From off-the-shelf to one-off custom

creations, oiling system performance requirements are most often dictated by specific racing applications, as noted by Jones earlier and confirmed by multiple other sources.

Temecula, California-based Dailey Engineering, which specializes in custom-made oil pumps, has found chassis manufacturers that can design around its custom-made billet dry sump oil pan and pumps up front, said Bill Dailey. "Instead of making something and forcing the cookie-cutter solution to engine builders, engine builders are requesting chassis to be made with our products in the beginning. With the high level of design available with computer solid modeling up front, we can supply in the computer world our complete dry sump system."

Verdi told us that because several series currently use or are considering spec engines, those markets could be in play down the road. "In some of the

series you are not allowed to use dry sump systems, so we are out [of those markets]. In the series where you can use dry sump systems, of course, things will happen and development will be done [by us]."

Speaking of future developments, Verdi believes they will include more varied-displacement pressure pumps, where the pump can produce more or less flow. "In some factory cars, it's already here. But it's not so easy to adapt into a dry sump system. They will be quite big parts, and we are looking into that," he said.

Verdi told us that custom-made oil pumps are more popular these days than universal pumps, which he said had their heyday 50 years ago.

"Today's engines are very tight in tolerances; that's why they will be very sensitive on the size of the pressure section," he said, adding that custom-made pumps require racing businesses to work closely together with their customers. **PR**

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